



Muon Arm Cost & Schedule

November 18, 1998

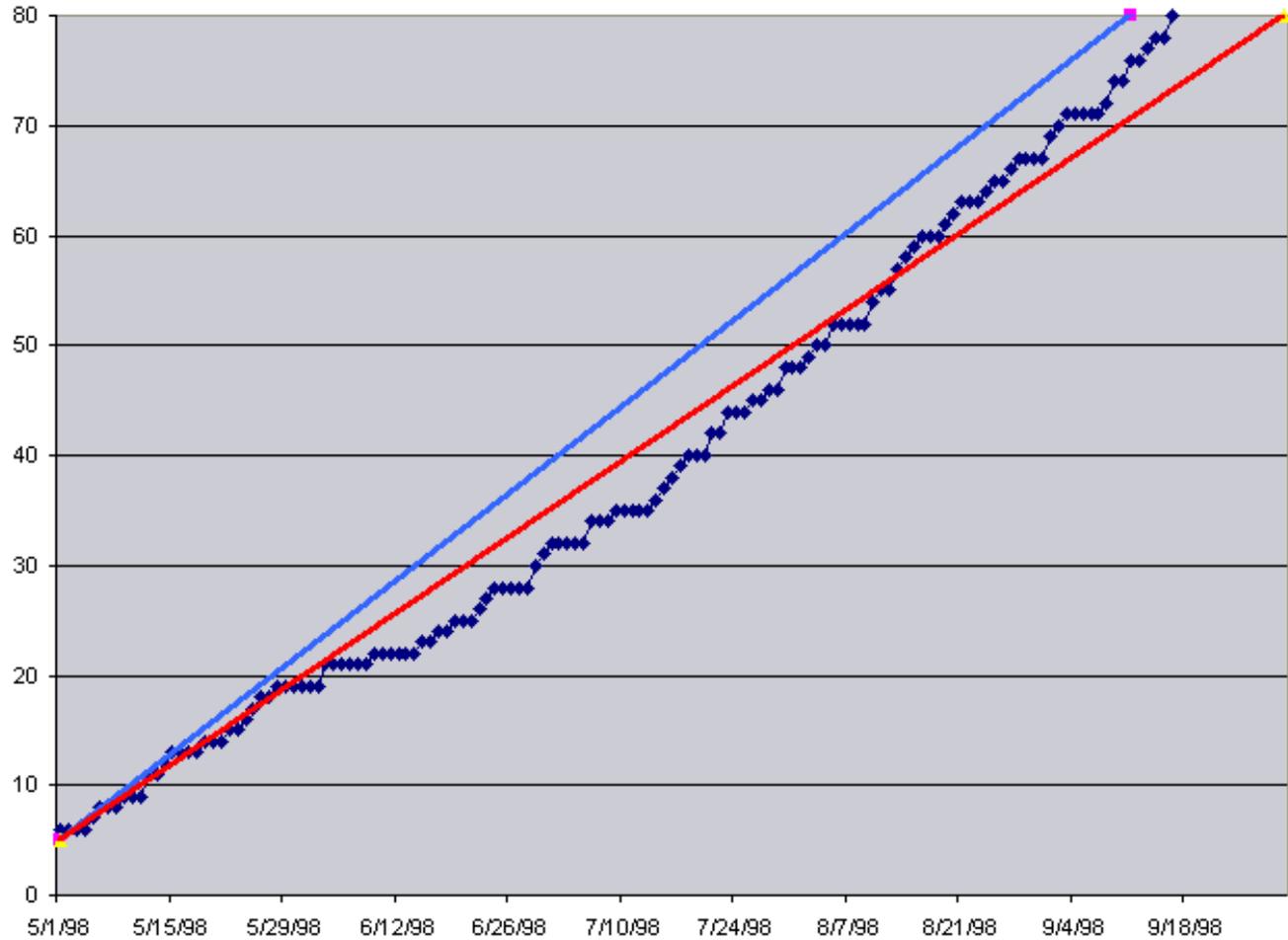
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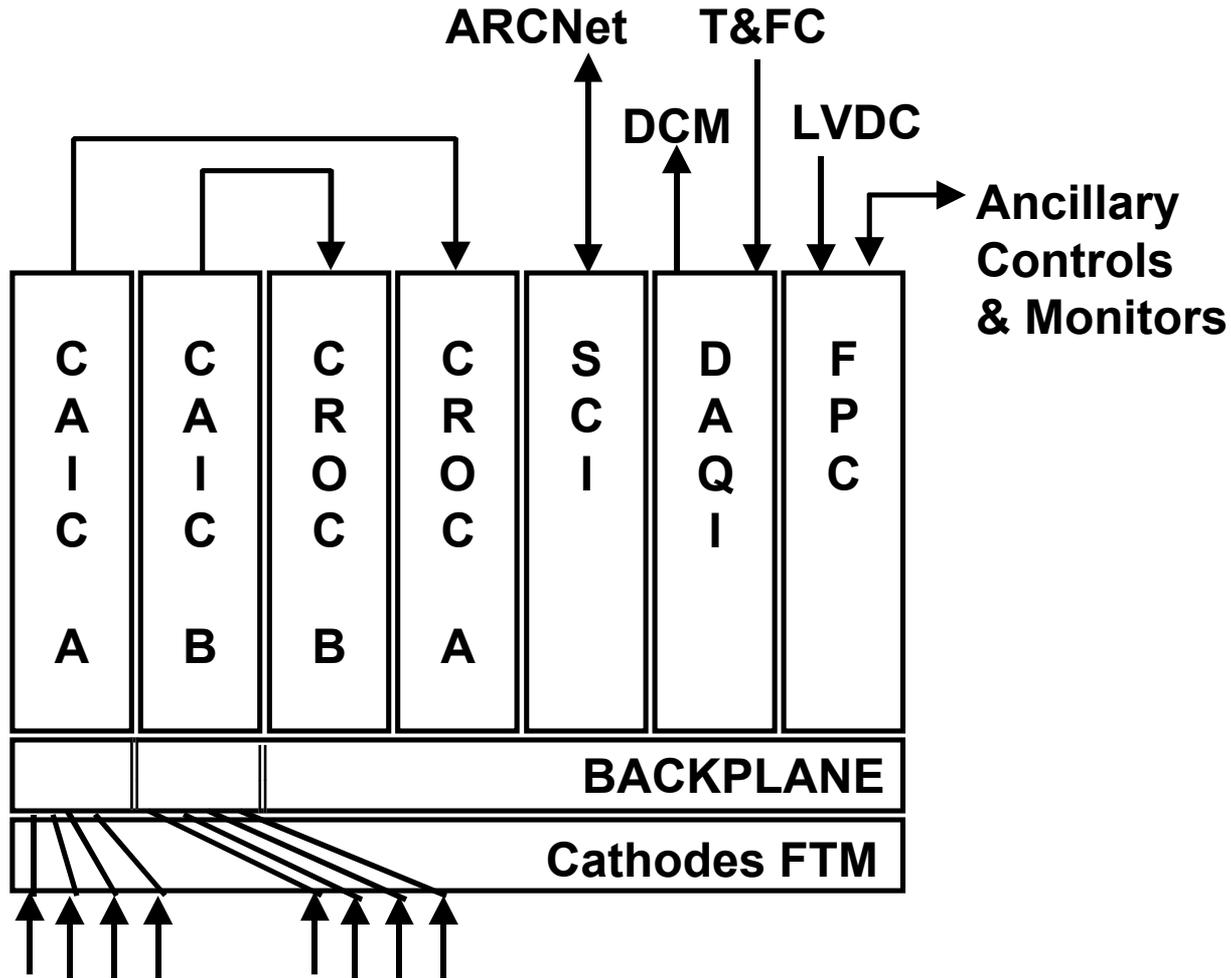
Progress Since TAC Review

- **All Muon ID Panels Now Installed**
- **μ ID FEE**
 - Continued work on design
 - Completed prototype of all digital sections of readout cards
- **μ Tr Mechanics Progress**
 - Completed nose cones and flowerpot designs
 - Completed factories at LANL and UNM
 - More prototype work completed for Station 3 construction
- **Improvements on the μ Tr FEE**
 - Simplified the design of the FEM's
 - Improved method for calibration
 - Will now pulse anode wire
 - Eliminate complex capacitor pulsing circuitry
 - Completed on-chamber tests of cathodes preamp ASIC (FDR scheduled for 9 Dec 1998)

All Muon ID Panels Now Installed



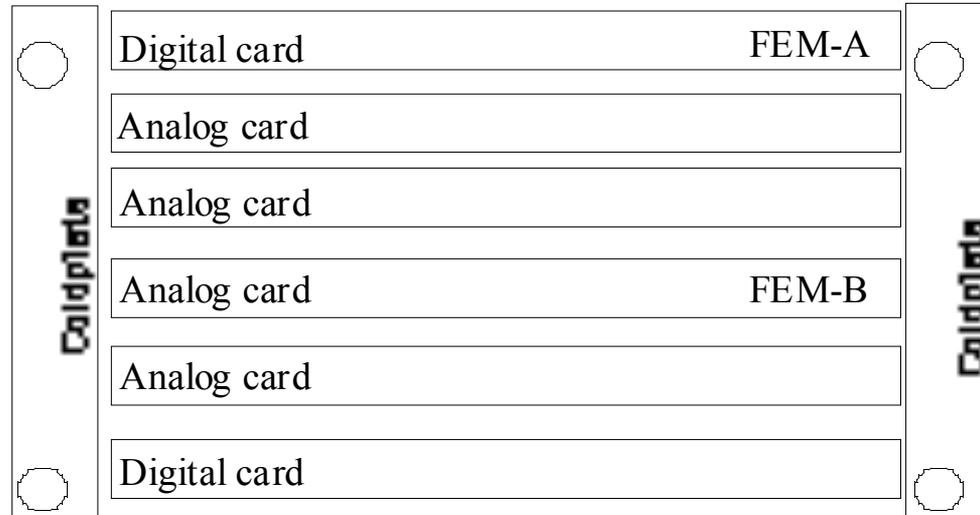
Original μ Tr FEE FEM



Cathode Detector Signals
(64 Strips/CROC, 4 Samples/Strip/Event)

Revised μ Tr FEE FEM

6U x 6-slot Chassis



Plan C Deliverables in FY 1999

- **MuID Mechanics** (\$120.0K)

- All panels installed and tested
- Maintenance gas system for both arms
- High voltage system installed

- **MuID FEE** (\$400.0K)

- Complete all designs
- Complete all prototypes

- **MuTr Mechanics** (\$1739.1K)

- Finish all engineering
- Construction South Arm Stations 1, 2, and 3
- Install South Arm Mechanics

- **MuTr FEE** (\$1,119.0K)

- Complete all designs
- Complete all prototype work
- Purchase components for construction of FEM's

Plan C Deliverables in FY 2000

- **MuID** **(\$544.0K)**

- South Arm gas system
- South Arm operational

- **MuTr** **(\$1706.3K)**

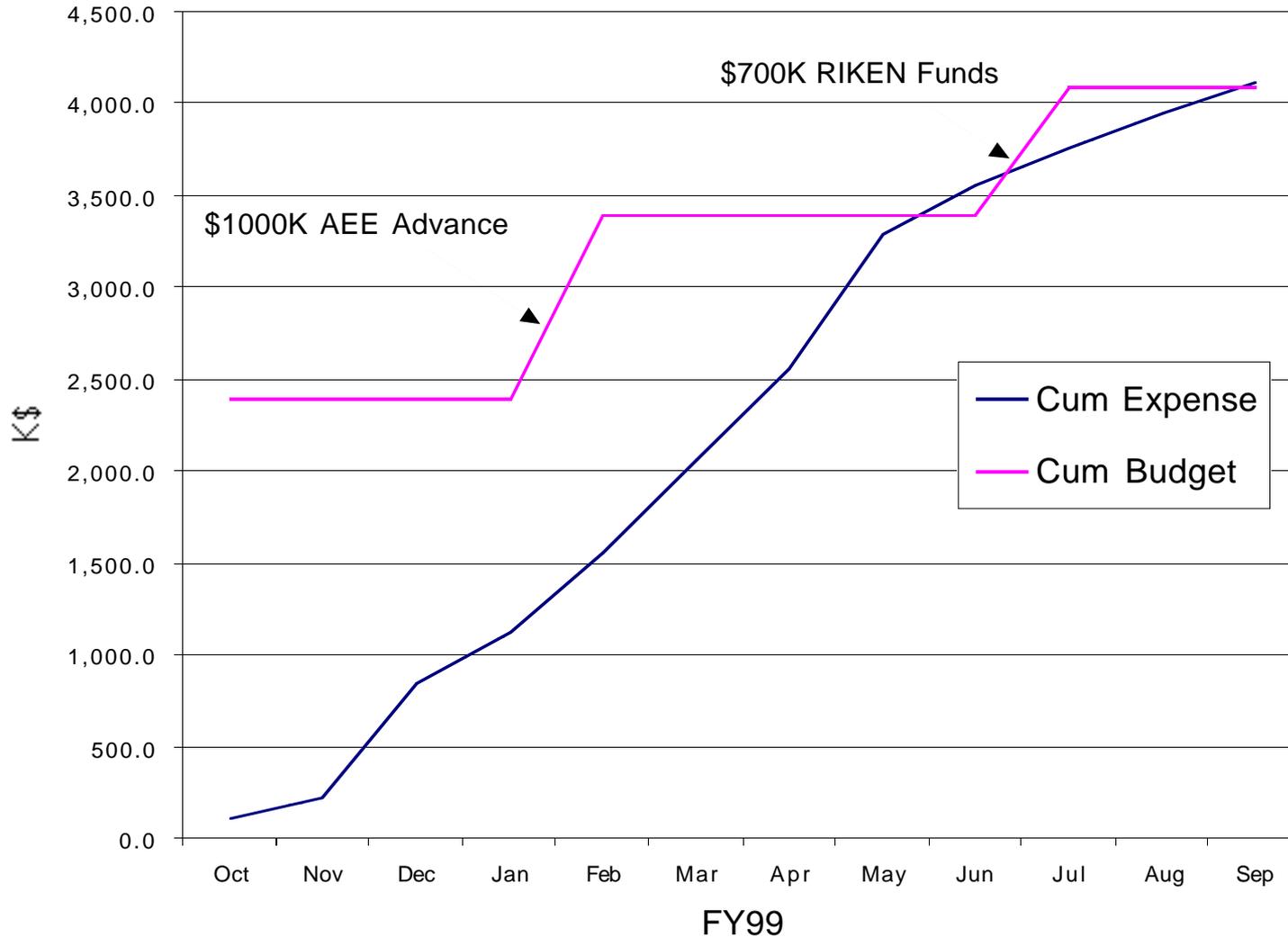
- FEE constructed and installed
- South Arm roll-in after commissioning
- Construct and install South Arm gas system
- Construct North Arm chambers

Install during summers of 2000 and 2001

Plan C Funding

	1999	2000	2001	Total
MuTr Mech	1,739.1	1,706.3	30.7	3,476.1
MuTr FEE	1,190.5	207.5		1,398.0
MuID Mech	120.0	324.0		444.0
MuID FEE	400.0	220.0		620.0
ARCNet				0.0
Timing & Control				0.0
DCM's				0.0
Installation/Integration	600.0			600.0
Incremental Overhead	64.8	51.0	0.5	116.3
LVL-1				0.0
ONCS				0.0
Expense Total	4,114.4	2,508.8	31.2	6,654.4
Cum Expense	4,114.4	6,623.2	6,654.4	
Carry Over	161.0			
AEE Budget	2,400.0	2,825.0		5,225.0
RIKEN Budget	1,531.0	400.0		1,931.0
Budget Total	4,092.0	3,225.0		
Cum Budget	4,092.0	7,317.0	7,317.0	

Cash Flow for Plan C



Milestones for Plan C

<u>Deliverable</u>	<u>Date</u>
Tracking Mechanics Services Ready for Installation	06/14/99
South Station 2 Installation Complete	10/06/99
South Station 1 Installation Complete	10/12/99
South Tracker FEE Mechanics Ready to Install	10/25/99
South Station 3 Installation Complete	11/16/99
Muon ID FEE Production Starts	10/01/99
North Tracker Mechanics Begins	10/01/99
South Tracker FEE Installation Complete	04/14/00
South Muon ID FEE Production Complete	04/01/00
South Muon ID Gas System Installation Complete	07/01/00

Muon Arms Cost History

- **November 1997 CDR for Muon Tracking FEE**

- Included TAC mandated all-fine cathodes
- First complete designs were costed

Large cost increase due to more complete consideration of mechanics and limitation of DCM bandwidth

- Plan to cover this by having anodes as contingency

- **May 1998 Muon Arms Mini-TAC**

- Descoped readout of the third gap of Station 3 chambers
- Cost estimates included anodes as contingency for project
- Recognition of need for advanced funding in FY 1999

- **August 1998 TAC**

- Cost growth in MuID mechanics

Driven by need to complete by October 1998 (six month)

More factory equipment

More labor

Increased costs for tubes

Costs for factory set-ups was too low

Cost evaluation was incomplete at time of review since MuID work was still in progress

Cost Growth Since August TAC

- **Estimated problem shown in August was \$1.43M**
- **Increases since August**
 - Final evaluation of increase in MuID was additional \$0.89M
 - Additional costs for expedited delivery
 - New estimates in MuTr mechanics is additional \$1.15M
 - New estimates due to increased material costs
 - More complete estimation of costs for factory
 - Maintaining labor pool which has been slowed down due to funding
 - Improved estimate in MuID FEE has gone up by \$0.2M
 - Schedule slippages have resulted in remaining (\$0.3M) growth
- **Cost reduction measures still being pursued**
 - Better bids for honeycomb panels could reduce cost by \$220K
 - Reductions in the MuTr FEE
 - New calibration method eliminates \$129K in equipment
 - Repackaging FEE will reduce the testing/installation costs

Cost Change Since TAC

Fiscal Year	1996	1997	1998	1999	2000	2001	Total	MTF	Delta
MuTr Mech	0.0	1,051.0	1,656.1	1,111.8	1,423.0	0.0	5,241.9	6,392.0	1,150.1
MuTr FEE	0.0	623.0	754.3	1,371.6	1,283.1	1,616.4	5,648.4	5,681.0	32.6
MuID Mech	0.0	505.5	2,716.3	149.5	0.0	0.0	3,371.3	4,258.0	886.7
MuID FEE	0.0	85.8	471.9	401.6	243.7	0.0	1,203.0	1,408.0	205.0
ARCNet	0.0	0.0	0.0	4.9	0.0	5.1	10.0	10.0	0.0
Timing & Control	0.0	0.0	0.0	81.5	0.0	87.2	168.7	169.0	0.3
DCM's	0.0	0.0	124.0	0.0	0.0	372.0	496.0	274.0	(222.0)
Installation/Integration	0.0	0.0	0.0	600.0	0.0	0.0	600.0	600.0	0.0
Incremental Overhead	0.0	29.8	68.7	23.9	41.7	23.1	187.2	100.0	(87.2)
LVL-1							0.0	197.0	197.0
ONCS							0.0	190.0	190.0
Total	0.0	2,295.1	5,791.3	3,744.8	2,991.5	2,103.8	16,926.5	19,279.0	2,352.5

Fiscal Year	≤1998			1999			2000			2001		
	Budget	MTF	Delta	Budget	MTF	Delta	Budget	MTF	Delta	Budget	MTF	Delta
MuTr Mech	2,707.1	2,667.0	(40.1)	1,111.8	1,945.0	833.2	1,423.0	1,709.0	286.0	0.0	71.0	71.0
MuTr FEE	1,377.3	1,410.0	32.7	1,371.6	1,371.0	(0.6)	1,283.1	1,283.0	(0.1)	1,616.4	1,617.0	0.6
MuID Mech	3,221.8	3,637.0	415.2	149.5	621.0	471.5	0.0	0.0	0.0	0.0	0.0	0.0
MuID FEE	557.7	618.0	60.3	401.6	490.0	88.4	243.7	490.0	246.3	0.0	0.0	0.0
ARCNet	0.0	0.0	0.0	4.9	5.0	0.1	0.0	0.0	0.0	5.1	5.0	(0.1)
Timing & Control	0.0	0.0	0.0	81.5	82.0	0.5	0.0	0.0	0.0	87.2	87.0	(0.2)
DCM's	124.0	124.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	372.0	150.0	(222.0)
Installation/Integration	0.0	0.0	0.0	600.0	600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incremental Overhead	98.5	0.0	(98.5)	23.9	31.0	7.1	41.7	48.0	6.3	23.1	21.0	(2.1)
LVL-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.0	197.0	0.0	0.0	0.0
ONCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	190.0	190.0	0.0	0.0	0.0
Total	8,086.4	8,456.0	369.6	3,744.8	5,145.0	1,400.2	2,991.5	3,917.0	925.5	2,103.8	1,951.0	(152.8)